

CLAIMS

1. A durable printed composite material, comprising:

5 a) a printable layer having a viewing surface and a printed surface, wherein an image is printed on the printed surface, said printable layer comprising a transparent or translucent material;

b) a metallic layer having an inner surface and an outer surface; and

10 c) an adhesive layer adhered between the inner surface and the printed surface such that at least a portion of said metallic layer is visible through the printable layer.

2. The material of claim 1, wherein said metallic layer comprises a reflective metal selected from the group consisting of aluminum, silver, indium, zinc, chromium, nickel, gallium, cadmium, palladium, molybdenum, gold,
15 copper, rhodium, niobium and composites or alloys thereof.

3. The material of claim 2, wherein said metallic layer comprises aluminum.

20 4. The material of claim 1, wherein said metallic layer further comprises a colorant.

5. The material of claim 1, wherein said metallic layer is a metal foil having a thickness of from about 0.01 μm to about 5 μm .

25 6. The material of claim 1, wherein the printable layer comprises a member selected from the group consisting of polyesters, cellulose esters, polyamides, polycarbonates, polyimides, polyolefins, polysulfonamides, and composites or mixtures thereof.

30 7. The material of claim 1, wherein the printable layer is transparent.

8. The material of claim 7, wherein the printable layer is polyethylene terephthalate.

5 9. The material of claim 1, further comprising a protective layer bonded to the outer surface of the metallic layer.

10 10. The material of claim 9, wherein the protective layer comprises a polymer selected from the group consisting of acrylic, epoxy, and mixtures thereof.

11. The material of claim 9, wherein the protective layer has a thickness of from about 0.5 μm to about 100 μm .

15 12. The material of claim 1, wherein the durable printed composite material has a thickness of from about 50 μm to about 250 μm .

13. The material of claim 1, wherein the durable printed composite material is flexible.

20 14. A durable printed flexible composite material, comprising:
a) a printable layer having a viewing surface and a printed surface, wherein an image is printed on the printed surface, said printable layer comprising a transparent or translucent material;
b) a metallic foil layer having an inner surface and an outer surface;
25 c) an adhesive layer adhered between the inner surface and the printed surface such that at least a portion of said metallic layer is visible through the printable layer; and
d) a protective layer adhered to the outer surface of the metallic layer;

30 wherein the durable printed composite material has a thickness of from about 50 μm to about 250 μm .

15. A method of forming a durable printed composite material, comprising steps of:

- 5 a) reverse printing an image on a printable layer to form a printed surface, said printable layer comprising a transparent or translucent material;
- b) providing a metallic layer having an inner surface and an outer surface;
- c) adhering the printed surface to the inner surface of the metallic layer; and
- 10 d) applying heat and pressure to the metallic layer,

wherein said inner surface of the metallic layer is at least partially visible through the printable layer.

16. The method of claim 15, wherein the step of reverse printing is
15 accomplished by a printing technique selected from the group consisting of ink-jet, laser, electrostatic, offset, gravure, and liquid electrophotography.

17. The method of claim 16, wherein the step of reverse printing is
20 accomplished by ink-jet or laser printing.

18. The method of claim 15, wherein heat and pressure is applied using
a heated roller.

19. The method of claim 15, wherein the metallic layer is a metal foil
25 comprising a metal selected from the group consisting of aluminum, silver, indium, zinc, chromium, nickel, gallium, cadmium, palladium, molybdenum, gold, copper, rhodium, niobium and composites or alloys thereof.

20. The method of claim 19, wherein the metal foil is aluminum.
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21. The method of claim 15, wherein the metallic layer further comprises
a colorant.

22. The method of claim 15, wherein the printable layer is transparent.

23. The method of claim 15, further comprising a protective layer bonded
5 to the outer surface of the metallic layer.

24. A system for forming a durable printed composite material,
comprising:

- 10 a) a printable layer comprising a transparent or translucent material,
said printable layer including a printable surface configured for receiving
a printed image; and
- b) a reflective metallic layer having an inner surface and an outer
surface, said inner surface being configured for adhering to the printable
surface.

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25. The system of claim 24, further comprising a printer configured for
reverse printing an image on the printable surface.

26. The system of claim 25, further comprising a contacting mechanism
20 configured for receiving said printable layer and said reflective metallic layer and
applying heat and pressure sufficient to adhere the inner surface of the
reflective metallic layer to the printable surface of the printable layer.

27. The system of claim 26, wherein the printer and contacting
25 mechanism are integrated as a single unit.

28. The system of claim 26, wherein said contacting mechanism
includes a heating element selected from the group consisting of a heated roller,
a ceramic heater element, and thermal printhead elements.

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29. The system of claim 26, further comprising a preheater configured for heating at least the reflective metallic layer, said preheater configured to be used prior to the contacting mechanism.

5 30. The system of claim 26, further comprising a dryer configured for drying the image prior to applying heat and pressure.

 31. The system of claim 24, wherein said reflective metallic layer is a metallized thermal transfer overcoat having a protective layer bonded to the
10 outer surface of the metallic layer.

 32. The system of claim 31, wherein said metallic layer comprises a metal selected from the group consisting of aluminum, silver, indium, zinc, chromium, nickel, gallium, cadmium, palladium, molybdenum, gold, copper,
15 rhodium, niobium and composites or alloys thereof.

 33. The system of claim 32, wherein the metallic layer comprises aluminum.

20 34. The system of claim 24, wherein the durable printed composite material, once formed, has a thickness of from about 50 μm to about 250 μm .

 35. The system of claim 24, wherein the durable printed composite material, once formed, is flexible.